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The invention relates to a pile disk heat-transfer agent with several cup shaped formed plates, which are provided in the distance one on the other-set connected dense at their peripheral edge and with projections to the mutual plant as well as with through holes in the faces of the projections in each case to each other, so that adjacent cavities are formed, which flowed through from different mediums, whereby in the stack at least two pile sections for different flow conditions are formed.

A pile disk heat-transfer agent of this type is known from the DE 199 06 180 A1. There it concerns to after-assign an other stack from heat transfer plates, which have larger profiles in contrast to the stack for the heating water as high delimitation than the plates for the heating water to storage, and it is there therefore provided, the stack from heat transfer plates, which between two end plates arranged is, however the water heating and -, so that the flow column planned there for the industrial water exhibit a larger cross section than those for the heating water.

With pile disk oil coolers, like them used are usually flowed through (see to DE 197 16 845 A1), all discs parallel. The heat exchange-flat becomes certain therefore by the number of the discs. Ever large therefore the number of disks and the heat exchange-flat becomes, all the more sinks the Reynolds number. There is therefore a maximum of discs, over which no increase in output can become more achieved, because then the advantage of a larger heat transfer surface becomes balanced by the disadvantage of the smaller heat transfer due to the smaller Reynolds number.

In motor vehicles, in particular during the transmission oil and fuel cooling, it is however necessary to exhaust relative large amounts of heat from small volumetric flows. The instant invention the object at the basis to look for a possibility of the increase of the heat dissipation without being to the enlargement of the heat transfer surface bonded.

This object becomes with a pile disk heat-transfer agent that initially mentioned type by the fact dissolved that flow path and residence time become one of the mediums - in the concrete case of an oil cooler those of the oil - in a pile section by deflection the inlet side enlarged, before the medium in the second pile section from the inlet side arrives to the expiration side.

By this embodiment a more intensive cooling of the oil becomes possible, without the heat transfer becomes smaller by dropping Reynolds numbers. The embodiment exhibits also the advantage that the prior construction of a pile disk oil cooler can be maintained.

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In development of the invention provided can become that all plates with two projections each and through holes for both mediums are provided to the entrance side and with two other projections and through holes to the return of each of the mediums. It will in this way possible to maintain also the usual construction of pile disk oil coolers with those and the removal of the refrigerant on a side and and the removal of the oil on the other side of the heat-transfer agent made.

In development of the invention the limitation of the pile section can become a formed plate the through hole leading to the return and into the pile section on other side limiting the plate the through hole the supply passage sealed in simple manner in. Overall construction and mode of production pile disk of heat-transfer agent can maintained which also by it still possible is that become provided in development of the invention and the exhausting opening for the two mediums on opposite sides of the pile disk block, on which one thrust washer each with the ports lies. Then a thrust washer on a side can be provided with reversing channels for the medium supplied at the other side.

The invention is shown on the basis an embodiment in the drawing and becomes in the following explained. Show:

Fig. 1 a schematic perspective view of a pile disk heat-transfer agent according to invention with schematic suggested flow directions of the mediums involved at the heat transfer,

Fig. 2 the view of one in Fig. 1 upper end plate not shown,

Fig. 3 the section along the line III III in Fig. 2,

Fig. 4 the schematic representation first to the thrust washer of the Fig. 2 adjacent heat-transfer agent plate,

Fig. 5 second to the plate of the Fig. 4 adjacent heat-transfer agent plate,

Fig. 6 a schematic explanation in the Fig. 4 and 6 - and in other figs - represented openings in the plates to the formation of the connecting ducts,

Fig. 7 to the heat-transfer agent plate of the Fig. 5 adjacent heat-transfer agent plate,

Fig. 8 to the plate of the Fig. 7 adjacent heat-transfer agent plate,

Fig. 9 to the heat-transfer agent plate of the Fig. 8 subsequent heat-transfer agent plate,

Fig. 10 to the heat-transfer agent plate of the Fig. 9 subsequent heat-transfer agent plate, with which the supply port for medium - oil - a sealed is,

Fig. 11 to the heat-transfer agent plate of the Fig. 10 adjacent heat-transfer agent plate, in whose cavity the flow direction of the oil is reverse,

Fig. 12 to the heat-transfer agent plate of the Fig. 11 adjacent heat-transfer agent plate,

Fig. 13 after interposition of three heat-transfer agent plates after the Fig. 11 and/or. 12 the subsequent heat-transfer agent plate, is sealed in which the supply opening for the oil,

Fig. 14 to the heat-transfer agent plate of the Fig. 13 adjacent heat-transfer agent plate, in of them with the heat-transfer agent plate after fig. 13 formed cavity the oil now again the flow direction takes, it in the cavity between the plate after Fig. 7 and Fig. 5 had,

Fig. 15 a variant of a heat-transfer agent plate for the formation of the cavity flowed through by the refrigerant and

Fig. 16 the heat-transfer agent plate for the formation of the cavity, flowed through subsequent to it, by oil.

In the Fig. 1 is pile disk according to invention a heat-transfer agent in the form of an oil cooler for an automobile engine shown. The pile disk heat-transfer agent participates - like actual known - constructed, which are on distance to each other stacked on top of one another and then at their edges dense connected, from several cup shaped designed plates, for example soldered. With the illustrated embodiment is to be assumed to the explanation 17 of such plates, like it in detail in the Fig. 4 to 14 shown is, stacked on top of one another is, whereby the plates 1 to 6 form a pile range, in which the oil of in known manner the formed feed channel, supplied in the sense of the arrow 20, 21 from to an opposite main sewer 22 and from there again the inlet channel 21 diverted becomes, before it withdraws by an outlet duct 23 in the sense of the arrow 24 the radiator.

▲ top The refrigerant - with the embodiment the refrigerant of the engine - on the top of the pile disk heat-transfer agent in the sense of the arrow 25 supplied, flowed through, remote from and the expiration side for the oil, in known manner it the associated cavities within pile disk of the heat-transfer agent, becomes then in a main sewer in the sense of the arrow 26 upward guided, there again diverted and withdraws in the sense of the arrow 28 the radiator. Natural one would be it possible to do without the deflection 27 and to let the refrigerant immediate withdraw from a respective opening in the sense of the arrow 26. In order to reach this type of the flow of the radiator with oil, the supply channel is 21 for the oil by locking the opening (29) in the pile disk No. 6 (see Fig. 13) at the other flow in the feed channel 21 upward hindered. Das Öl wird daher durch seine zugeordneten Kammern, die jeweils benachbart zu Kammern liegen, die vom Kühlmittel durchströmt sind, im Sinn der Pfeile 30 zum Sammelkanal 22 fliessen und wird von dort aus durch das Verschliessen der Verbindungsöffnung 31 in der Platte 12 (Fig. 10) forced to flow now in the sense of the arrows 32 back to the supply passage 21 in order to be able to then withdraw from there out of in the last discs 13, 15 and 17 again in the sense of the arrows 30a back to the main sewer 22 and from there over the deflection 33 by the outlet duct 23 in the sense of the arrow 24 downward.

The oil puts in this way within the pile disk radiator a larger path than that the case would have been, if it had flowed into known manner of the feed channel 21 out in the counterflow to the refrigerant only from one to the other side in the corresponding hollow chambers. The residence time of the oil within the radiator becomes increased thereby, and it can become the heat transfer enlarged, without the risk exists that from the flowing through quantity and the gap-high within the hollow chambers and thus from the flow rate dependent Reynolds number would become small, in order to obtain still another heat transfer factor in the region of the turbulence. It is natural easily possible and also necessary to determine the number of the plates located in the pile sections and thus the Gesamtquerschnitt for the flow differently than this on the basis the embodiment to the purpose of the explanation shown is now. The pile section 34, which covers the plates 1

to 12 with the embodiment, should exhibit however always for instance the double number of plates, like the pile section. 35, if the same flow rate in all of the oil flowed through cavities is to be maintained.

The Fig. those shows 2 the stack after Fig. 1 final above end plate 18, those in Fig. 1 from reasons of clarity shown is not. This plate 18 possesses a port 37 and a second port 38 for the return of the refrigerant in the sense of the arrow 28 in the region of the feed channel 36 for the refrigerant. Furthermore it is provided with a Auswölbung 39 and a connecting duct 40 for the deflection of the refrigerant of the main sewer 26 to the discharge part 38 and of the main sewer 22 of the oil to the outlet duct in the sense of the arrow 24 in each case. The highest plate of the stack adjacent to this plate 18, which forms the last cavity durchflossenen of oil, possesses an open supply opening 21 in the region of the supply channel and a likewise open opening in the region of the main sewer 22. The connection a communication port 23 final to the adjacent cooling agent-flowed through chamber leads to the channel 40 of the deflection 39 and/or. to the hollow chambers located under it which are flowed through by oil, in order to make a reflux possible in the sense of the arrow 24. In addition the plate 17 possesses the openings 26 and 37, which are in actual known manner at the face of projections mounted in each case, which can to be frustoconical formed and exhibit an height, which reaches up to the adjacent plate. These truncated cones can become therefore dense with the adjacent plate connected, so that the opening 37 and 26 for the refrigerant in the cavity formed of the plate 17 - which is locked for flow with oil intended actual. The Fig. schematic is to show 6, how the representation of the truncated cones is to be understood 41. They represent in each case the connection of the cavities flowed through by the same medium among themselves, whereby all cavities of oil, formed of the plates with odd numerals, and the cavities of the refrigerant, formed of plates provided with straight numerals, flowed through, this show also Fig. 5, where the plate forms flowed through cavity for 16 one of the refrigerant, whereby out of the feed channel 37 the refrigerant flows here into the cavity and leaves this again by the collecting and return flow channel 26.

This system sits down, like the Fig. 7 to 9 shows, downward always alternate away, up to the plate 12 (Fig. 10), with now the communication port 31, the actual connection of the two to the plate 12 adjacent, of the plates 13 and/or. 11 formed and of the oil flowed through cavities would form, closed is.

This leads to it, like Fig. it shows 11 that the oil flows in the chamber opposite, i.e. into the sense of the arrows 32 and no more in the sense of the arrows 30, formed of a plate 11. Of the plates 11, 9 and 7 (the plates 9 and 7 are not in detail shown, because them the plate 11 after Fig. 11 corresponds) flowed through cavities therefore all in the sense of the arrows to 32 is flowed through, whereby the oil back-flows here from the main sewer 22 out to the feed channel 21. The disc 6 (Fig. 13) now a communication port possesses 29, which is similar as the opening 31 of the disc 12 sealed, so that incipient with of the plate and/or. Disc 5 formed cavity the oil again in the sense of the arrows 30 of that the supply passage 21 connected opening out to the main sewer 22 flows. This sits down away in the cavities formed of the plates not shown 3 and 1, whereby subsequent to the plate 1 becomes an end plate provided provided with the ports for the oil. In this way and the removal openings for the refrigerant are 28 and 36 on a side of the pile disk heat-transfer agent and - not shown - and the exhausting connecting pieces for the oil (in the sense of the arrows 20 and 24 and discharged becomes) on the opposite side of the pile disk radiator provided.

The Fig. 15 and 16 shows modified discs 42 and/or. 43 for the flow with refrigerant (sheet 42) and/or. Oil (sheet 43). Here is in each case 45 provided between the feed channels 44 for the refrigerant and the associated drainage canal to arrange partitions 46 by which the refrigerant forced will put, a longer path back within the chamber formed of the plate 42. This applies also to the chamber formed of the plate 43 to the flow with oil, where are 49 arranged between the supply ports 47 and 48 four partitions, which force upon mA-other-like current to the oil. Also this measure serves for the increase of the heat transfer, as this already known actual with other heat-transfer agents is.

It turned out that by the deflection in the pile sections 34 and 35 - as described - and with use of plates after the Fig. 15 and 16 an efficiency for the heat transfer up to 90 DEG possible is. Standard stack disk oil cooler - even if it with deflections in the plates in accordance with Fig. 15 and 16 is provided - only maximum efficiencies of approx. reach. 60%.

▲ top The formation of the flow according to the present invention brings therefore advantages regarding the heat transfer. The disadvantages regarding the Reyonoldszahl, resultant with the state of the art by increase of the transfer surface, however avoided become.

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1. Pile disk heat-transfer agents with several cup shaped formed plates (1 to 17), those in the distance one on the other-set connected dense at their peripheral edge and with projections to the mutual plant as well as with through holes (channels 21, 22, 26, 36) to the connection with other cavities provided are in each case to each other, whereby adjacent cavities of different mediums from an inlet side flowed through to an expiration side and in the stack at least two pile sections for different flow conditions formed are, characterised in that flow path and residence time one of the mediums in a pile section (34) by deflection to the inlet side (21) enlarged become, before the medium in the second pile section (35) from the inlet side to the expiration side (22) arrives.

2. Pile disk heat-transfer agents according to claim 1, characterised in that all plates (1 to 17) with two projections each with through holes for both mediums and with two other projections and through holes to the return of each of the mediums to the entrance side are provided.

3. Pile disk heat-transfer agent according to claim 1, characterised in that in the limitation of the pile section (34) a formed plate (12) the through hole (31), leading to the return, and in the plate (6), partitioning the pile section, the through hole (29) to the feed channel (21) sealed is.

4. Pile disk heat-transfer agent according to claim 1, characterised in that and exhausting openings (37, 38 and/or. 20, 24) for the two mediums on opposite sides of the pile disk block at in each case a thrust washer (z. B. 18) provided are.

5. Pile disk heat-transfer agent according to claim 4, characterised in that the thrust washer (18), planned on a side, with reversing channels (40) for the medium supplied at the other side is provided.

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6. Pile disk heat-transfer agent according to claim 1, characterised in that the single plates (42, 43) with partitions (46 and/or. 49) to the deflection of the flowing through medium within the gap-like hollow chamber are provided.